RF/RMRS-97-123

CORRES. CONTROL
OUTGOING LTR. NO.
DOE ORDER #5480.21

98-RF-00506

DIST.	LTR	ENC
Bacon, R. F.	X	
Bader, C. F.		
Ball, J. M.		
Bodey, E. D.		
Del Vecchio, D. C.		
Dillie, D. R.		
Hammond, J. H.		
Hamrick, D. G.		
Hamrick, J. C.	X	
Heath, D. L.		
Hickman, M. E.	X	X
Hilbig, J. G.		
Hoovler, G. S.		
Hunter, D. L.		
Jackson, J. F.		
Korenko, M. K.	X	
McKibbin, J. G.		
Newland, D. J.		
Pasquini, L. A.		
Raish, S. C.		
Raaz, R. D.		
Rodriguez, M. P.		
Ryan, K. E.		
Sax, S. M.		
Serafin, K. A.		
Stalling, J. W.		
Suyama, R. M.		
Swaim, D. J.		
Trice, K.	X	
Truax, J. E.		
Wolf, H. C.	X	
Wolf, K. Z.		
Zbryk, K. O.	X	
Harrawood, K.	X	X
Goff, T.	X	X
Grube, M.	X	X
OFFICIAL FILE	X	X
CORRES.CONTROL	X	X
ADMIN RECRD/080		
TRAFFIC		
ATS/T130G		

CLASSIFICATION:		
UCNI		
UNCLASSIFIED	X	X
CONFIDENTIAL		
SECRET		

AUTHORIZED CLASSIFIER SIGNATURE:

Date:

REPLY TO RFP CC NO

ACTION ITEM STATUS:
[ ] PARTIAL/OPEN
[ ] CLOSED

LTR APPROVALS:
Manager
Chief Engr DPS

ORIG. & TYPIST INITIALS
ras

46469(Rev.6/94)

Legacy Sites of Colorado & Rocky Mountain Remediation Services

779 Closure Project

January 21, 1998

98-RF-00506

John W. Whiting
779 Cluster PBS Manager
Kaiser-Hill
Rocky Flats Environmental Technology Site

SUBJECT: CLOSEOUT OF RADIOLOGICAL SURVEY PLAN - MEH-003-98

Attached are five copies of the Closeout Radiological Survey Plan for the 779 Cluster. Please forward a copy of the subject plan to the Department of Energy (DOE) for their review.

We are scheduled to complete demolition of several buildings in the 779 Cluster this fiscal year, (i.e., Building 727 and 729). One of the first steps in reaching this goal is to identify who will complete the independent Radiological Survey prior to demolition. After identifying who will complete these verifications, an interface protocol with the 779 Project personnel needs to be set up that allows for a timely and quality review process. In order to complete this aggressive schedule it is imperative that DOE respond to the following questions:

1. Who will be conducting the independent Radiological Verification Survey?
2. How will the Survey be coordinated?

If you have any questions, please don't hesitate to contact me at extension 7145.

Mark E. Hickman
Integration Manager
779 Cluster Closure Project
Rocky Mountain Remediation Services

ras

Encl: 5

ADMIN RECORD
B779-A-00020

RF/RMRS-97-123

Closeout Radiological Survey Plan

For The 779 Cluster

Rocky Mountain Remediation Services, L.L.C.

January 1998

REVIEWED FOR CLASSIFICATION
By
Date 1/27/98

779 CLUSTER DECOMMISSIONING PROJECT
CLOSEOUT RADIOLOGICAL SURVEY PLAN

REVISION 0

JANUARY 1998

This Closeout Radiological Survey Plan has been reviewed and approved by:

Thomas E. Goff — 1/19/98
Tom Goff, Bldg. 779 Radiological Engineer (SSOC) — Date

1/19/98
Ken Harrawood, Bldg. 779 Radiological Safety Authority (SSOC) — Date

1/22/98
Mark Hickman, Bldg. 779 Integration Manager (RMRS) — Date

for M. Korenko — 1/22/98
Mike Korenko, Bldg. 779 Project Manager (RMRS) — Date

This Closeout Radiological Survey Plan was prepared by:

1/19/98
Michael Grube, Final Survey Radiological Engineer (SEG CO) — Date

CLOSEOUT RADIOLOGICAL SURVEY PLAN

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APPENDICES

CLOSEOUT RADIOLOGICAL SURVEY PLAN FOR THE 779 CLUSTER

1.0 PURPOSE

The purpose of the Closeout Radiological Survey Plan (CRSP) is to define the methods for collecting, analyzing, and documenting data to demonstrate that any radiological contaminants existing in the 779 Cluster are below levels that comply with established Rocky Flats Environmental Technology Site (RFETS) release criteria identified in Appendix A. This appendix is derived from DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, NRC Regulatory Guide 1.86, *Termination of Operating Licenses for Nuclear Reactors*, and Appendix 1, Site Procedure 1-P73-HSP-18.10, *Radioactive Material Transfers and Unrestricted Release of Property and Waste*. The survey will include the floors, ceilings, interior and exterior walls, accessible surfaces of the roof, and fixed equipment. Those areas that contain radioactive material above the unrestricted release criteria will be decontaminated to meet the release criteria, managed as radioactive material, or released in a restricted manner.

2.0 DESCRIPTION

2.1 DECOMMISSIONING CLOSE-OUT RADIOLOGICAL SURVEY SCOPE

The scope of this Decommissioning Closeout Radiological Survey consists of the survey of the applicable buildings in the 779 Cluster to the criteria in Appendix A.

2.2 FACILITY HISTORY

2.2.1 Building 779

Building 779 was originally constructed in 1965. The building was expanded in 1968 and again in 1973. The additions are referred to as Building 779-A and Building 779-B. Since all three additions are physically connected, and share resources and mission, any reference to Building 779 should be understood to include all three additions.

The first addition to Building 779 (Annex A) was completed in 1968. The addition added office space, laboratory area dedicated to pyrochemical technology, hydride operations, physical metallography, joining technology, and the necessary heating, ventilation, and air conditioning (HVAC) equipment to supplement the existing HVAC system. The 1968 addition is a single story facility attached to the north end of Building 779.

The second addition to Building 779 (Annex B) was made in 1973. The addition is a two-story facility added to the south side of the original Building 779. Although both additions are architecturally and structurally different from the original Building 779, they are functionally tied to the original building.

Building 779 was used as a Research &Development Center. Building 779 contained process equipment which could mimic some of the production facilities' mission, and laboratory equipment to conduct material and environmental testing.

2.2.2 BUILDING 779 SUPPORT FACILITIES

The Building 779 Support facilities are described below.

Along with the two building additions, two filter plenum buildings were constructed after Building 779 was completed. Building 729 was constructed in 1971, and contains a filter plenum and an emergency electrical power generator. Building 729 is connected to Building 779 via a second story bridge and supports Annex B. Building 729 has dimensions of 72 feet x 38 feet and is located immediately south of Building 779. Building 782 was constructed in 1973, and serves as the second filter plenum for Building 779. Building 782 covers 60 feet x 99 feet and is located east of Building 779. The emergency generator for Building 782 Is located in Building 727, located north of Building 782.

The following buildings are located adjacent to each other, northeast of Building 779, and north of Building 727:

Building 783 - Cooling Tower Pump House
Building 784 (A,B,C,D) - Cooling Tower
Building 785 (A&B) - Cooling Tower
Building 786 - Cooling Tower West Chiller
Building 787 (A, B,C,D) - Cooling Tower West Chiller
Building 780
Building 780A
Building 780B

3.0 SCOPE

The surveys of the buildings will include all floors, interior wall and ceiling surfaces, and accessible surfaces of exterior walls, roof, and fixed equipment.

The scope of the 779 Cluster Decommissioning Project Closeout Radiological Survey as defined in this document is to:

- Provide a description of the graded approach used in determining the intensity of sampling and survey data gathering which must be obtained to make the determination that the 779 Cluster meets the release criteria of Appendix A.
- State how the characterization data obtained will be used to support the final decommissioning decision.
- Develop a survey and sampling approach which, when implemented, will obtain adequate information to demonstrate that the buildings identified have no contamination levels above the release levels stated in Appendix A.
- State the release criteria which will be used to free release the buildings.

4.0 SURVEY OBJECTIVES

The survey is designed to demonstrate that radioactive contamination is not above the applicable release criteria in the identified project buildings. The survey objectives are:

- Provide a reliable and systematic approach to evaluating survey data used to demonstrate specific release criteria is met.
- Provide the methods which will be used in implementing the graded approach to verify decontamination efforts if required are complete, and to verify all areas surveyed meet the unrestricted release criteria in Appendix A.

5.0 SITE ASSESSMENT

5.1 CONTAMINATION IDENTIFICATION AND SURVEY REQUIREMENTS

5.1.1 Historical Site Assessment

Based on the, review of historical records, process knowledge of the identified project buildings and associated equipment/systems, and the result of radiological surveys, contamination has been identified as follows:

- From a radiological contamination standpoint, Building 779 has been divided into two areas based on removable contamination potential. The areas are classified as "Contamination Areas" (CA) and "Radiological Buffer Areas" (RBA). All rooms presently in the CA will be initially classified as Multi-Agency Radiation and Site Investigation Manual (MARSSIM), Draft 12/96, Class 1. See Appendix D for room/building process history and additional details on classifications for final survey.
- Significant levels of plutonium and to a lesser extent uranium and americium contamination exist in a majority of the gloveboxes, hoods, and ventilation systems in Building 779.
- Contamination on floor and wall surfaces in many rooms has been fixed with paint.
- A significant number of spills have occurred in many of the laboratory areas. The potential exists for contamination to be in floor cracks as well as beneath the asbestos floor tiles.
- Numerous incidents of high airborne activity have potentially contaminated many surface areas of Building 779.
- Buildings 729 and 782 contain significant levels of contamination in the filter plenums. The filter plenums are all designated "Contaminated Areas" (CA) or "High Contamination Areas" (HCA). See Appendix D for room/building process history and additional details on classifications for final survey.

5.1.2 Characterization, In-Process and Equipment/Material Release Surveys

In-Process characterization surveys will be performed during the removal of fixed equipment, and strip-out of the buildings. It is anticipated that a majority of the equipment and material will be disposed of as radioactive waste. Material and equipment designated for unrestricted release will be surveyed extensively and released in accordance with Site Procedure 1-P73-HSP-18.10, *Radioactive Material Transfer and Unrestricted Release of Property and Waste.*

Painted surfaces and floor tiles/adhesive will be handled in accordance with one of the following, as applicable: (See Appendix E for Paint/Bulk media sampling protocol)

- Representative paint/bulk media samples will be obtained and material released after final survey measurements are made (if RFETS unrestricted release criteria for the samples and survey data is met. This protocol would normally apply to Class 3 areas and the filter plenum buildings).
- Painted material/areas suspected of covering contamination will be scabbled prior to being final surveyed. (Typically this protocol will apply to Class 1 laboratory areas)
- Floor tile/adhesive will be removed prior to the performance of final surveys.
- Painted material/areas not scabbled or sampled will be processed as radioactive waste.

Building systems will be generally surveyed as follows:

- All ventilation, exhaust, and process systems are considered internally contaminated and disposed of as radioactive waste or surveyed and released in accordance with Site Procedure 1-P73-HSP-18.10, *Radioactive Material Transfer and Unrestricted Release of Property and Waste.*
- Pressurized gas systems will be classified as non-impacted internally, but will be surveyed on accessible external surfaces and released in accordance with Site Procedure 1-P73-HSP-18.10, *Radioactive Material Transfer and Unrestricted Release of Property and Waste.*
- The most recent sample of the domestic water system periodically obtained by RFETS will be evaluated to verify the system is free of internal contamination. Accessible external surfaces of domestic water system piping will be surveyed and released in accordance with Site Procedure 1-P73-HSP-18.10, *Radioactive Material Transfer and Unrestricted Release of Property and Waste.*
- Other miscellaneous systems will be classified and evaluated on a case-by-case basis.

5.1.3 Final Survey

Final surveys will be performed on an ongoing basis on areas that have been stripped out and released for survey. Radiological survey instructions and survey maps (See Appendix F for an example of typical survey instructions) will be provided to Radiological Operations by the Final Survey Radiological Engineer when the area is ready for final survey. Survey instructions for building survey areas will be written in accordance with he most current MARSSIM classifications. (See Appendix D for initial classifications)

5.2 SEVEN STEP DQO PROCESS

The following seven step process derived from EPA QA/G-4, *The Data Quality Objective Process* and the Draft MARSSIM (Multi-Agency Radiation Survey and Site Investigation Manual) and Manual (NUREG-1575) is being utilized to develop a CRSP for the 779 Cluster. The CRSP was designed to identify the survey requirements which, when completed, would demonstrate compliance with the Appendix A release criteria.

Step 1 - State the Problem

Why perform this survey?

This survey is being performed to assure that the 779 Cluster facilities' materials to be released contain no radioactive contamination above the unrestricted release criteria outlined in Appendix A.

What types and kind of sampling measurements are required?

The radiological surveys required to assure that the unrestricted release criteria is met are fixed and removable surveys for gross beta and/or gross alpha contamination. These surveys are performed at distinct locations in the 779 Cluster.

Since small areas of radioactive material may be present between the fixed and removable surveys, scan surveys will also be performed. These surveys are performed across defined areas of the 779 Cluster.

Paint/surface media samples will be obtained to ensure contamination above the RFETS unrestricted release criteria does not exist below painted surfaces.

Who needs the information?

The Department of Energy, Environmental Protection Agency, Colorado Department of Public Health and the Environment, Stakeholders, Kaiser-Hill, Safe Sites of Colorado and Rocky Mountain Remediation Services will use the CRSP results to assure that the material from the 779 Cluster can be released in an unrestricted manner.

When is the information needed?

The survey results from the CRSP are needed for each survey area before the dismantlement of the survey area in the 779 Cluster. (e.g., Individual structures may be dismantled upon completion of the final survey for the structure.)

Step 2 - Identify the Decision

What decisions will be made from this final survey information?

Structures and components of the 779 Cluster will be released in an unrestricted manner when it is shown that the unrestricted release criteria are met.

If the surveys show that the areas in the 779 Cluster do not meet the unrestricted release criteria, the area exceeding the criteria will be decontaminated or removed. The decontaminated area will then be resurveyed to assure that the unrestricted release criteria is met. If the unrestricted release criteria cannot be met, the area exceeding the criteria will not be released in an unrestricted manner.

Are there any alternatives to the decision?

There are no other alternatives for the 779 Cluster. The Site Utilization Review Board (SURB) and DOE Management have made the decision that the 779 Cluster facilities are excess.

What is the end use of the equipment, facility or structure (free release, restricted use, low level waste, etc.)?

Structures and components within the 779 Cluster which have no radioactive material contamination above the unrestricted release criteria, may be released in an unrestricted manner. If areas within the 779 Cluster contain radioactive material above the unrestricted release criteria and cannot be decontaminated, these areas will not be released in an unrestricted manner.

Step 3 - Identify Inputs to the Decision

What information is required to make this decision?

The information required are the radiological survey data that will support a decision to release the structures and components of the 779 Cluster in an unrestricted manner. The radiological surveys required are scan, fixed and removable surveys for gross beta and/or gross alpha contamination. These surveys are performed at distinct locations within the 779 Cluster. (See Appendix F for example radiological survey instructions)

Scan surveys are performed in addition to fixed and removable surveys so that the probability of finding radioactive material above the unrestricted release criteria is maximized. These scan surveys are performed across a defined area within the 779 Cluster.

Paint/surface media samples will be obtained to ensure contamination above the RFETS unrestricted release criteria does not exist below painted surfaces.

What source(s) can be used to obtain the information?

Reconnaissance Level Characterization surveys and in-process characterization surveys. If these surveys do not satisfy the requirements of the CRSP, additional surveys will be required so that the requirements of the CRSP are met.

Can the desired analyses be performed at RFETS or will the analysis be sent off-site?

All radiological survey data will be obtained and recorded at the 779 Cluster. This data will be reviewed at RFETS. Surface media samples will be performed by on-site RFETS laboratories. It is not anticipated that samples will be sent off-site for analysis.

What type of instrumentation will be required?

The instrumentation in Appendix B will be used to perform all radiological surveys. The Minimum Detectable Activities (MDA) of the instruments used to perform the surveys required in this CRSP will be a fraction of the unrestricted release criteria outlined in Appendix A. A goal will be to have the MDA of an instrument at or below 50% of the unrestricted release criteria. The MDAs listed are worse case based on the lowest acceptable efficiency and highest acceptable background. Additional survey equipment may be used as required by Radiological Engineering.

Has facility structural data been reviewed?

Structural data is being reviewed on an ongoing basis by qualified structural engineers. Prior to modifications to the building structures, approval will be obtained from Engineering.

What suspect materials have been identified?

Plutonium, Americium, and Uranium have been identified as nuclides that may be present in the 779 Cluster. Buildings 779, 782 and 729 contain Radiological Buffer Areas, Contamination Areas and High Contamination Areas which contain isotopes of plutonium and americium. (See Appendix D for additional details)

Step 4 - Define the Study Boundaries

What is the scope of this final survey?

The floors, walls, ceilings, roof, and fixed equipment in the 779 Cluster will be surveyed. Concrete and asphalt surfaces, soil and utility equipment not physically connected to the 779 structures is not within the scope of this CRSP.

What is the sample population of interest?

The floors, interior and exterior walls, ceiling, roof and fixed equipment located within the 779 Cluster are the population of interest.

What kind of radiological hazard is being evaluated?

Fixed and removable radioactive contamination is present throughout the 779 Cluster and is the hazard being evaluated. The known radioactive material present is plutonium, americium, and uranium. These nuclides are primarily high energy alpha emitters and are therefore considered skin and internal dose hazards. There are four modes of entry of radioactive material into the body: inhalation and deposition into the respiratory tract; injection; ingestion; and absorption through the skin. Plutonium is the primary nuclide of concern. The principle organs affected by plutonium with the corresponding approximate biological half-lives are as follows:

lungs	0.5 to 500 days based on the solubility of the radioactive material
liver	20 years
bones	50 years

To put the hazard into perspective, an acute exposure to a worker from the inhalation of about 5000 picocuries of Pu^{239} in an oxide form would result in a first year and 50-year committed effective dose equivalent of 150 mrem.

Are there any constraints on data collection?

Data collection is performed in accordance with the requirements of:

NUREG/CR-5849 - *Manual for Conducting Radiological Surveys in Support of License Termination*

Draft MARSSIM - *Multi-Agency Radiation Survey and Site Investigation Manual.*

The survey methods utilized are in conformance with the following RFETS procedures:

4-K62-ROI-03.01 *Performance of Surface Contamination Surveys*

4-S23-ROI-03.02 *Radiological Requirements for Unrestricted Release*

4-Q97-REP-1003 *Radiological Evaluation for Unrestricted Release of Property/Waste*

1-P73-HSP-18.10 *Radioactive Material Transfer and Unrestricted Release of Property and Waste*

DOE Order 5400.5, *Radiation Protection of the Public and the Environment*

NRC Reg. Guide 1.86, *Termination of Operating Licenses for Nuclear Reactors*

What sample measurement locations (densities) are necessary to get the desired certainty?

All areas of the building cluster do not have the same potential for radioactive material being present and, therefore, do not require the same level of survey coverage to achieve an appropriate level of confidence that building surfaces satisfy established unrestricted release criteria. The CRSP is designed so that areas with higher potential for contamination receive a higher degree of survey effort. This will ensure that the CRSP is both effective and efficient.

The following area classifications with their associated survey frequencies are based on guidance from:

NUREG/CR-5849 - *Manual for Conducting Radiological Surveys in Support of License Termination.*

Draft MARSSIM - *Multi-Agency Radiation Survey and Site Investigation Manual.*

Four area classifications were used to design the 779 Cluster CRSP. These classifications are defined as follows:

- Class 1 Impacted (Affected) Areas: are areas that have potential contamination (based on building operating history) or known contamination (based on past or preliminary characterization survey data). This would normally include areas where radioactive materials were used and stored and where records indicate spills or other unusual occurrences could have resulted in the spread of contamination. The survey frequency will be a beta and/or alpha scan survey of 100% of the applicable surface areas, including fixed equipment and a minimum of one fixed survey measurement and one removable survey measurement per square meter. In addition, biased surface media samples will be obtained for radiochemistry analysis as determined by Radiological Engineering.

- Class 2 Impacted (Affected) Areas: are areas that have or had a potential for radioactive contamination or known contamination, but are not expected to exceed the applicable contamination limits. The survey frequency will be a scan survey for alpha and beta of 10 to 100% of the applicable surface areas, including fixed equipment, as delineated in survey instructions. (See Appendix E), and a minimum of one fixed survey measurement and one removable survey measurement at intervals as determined utilizing MARSSIM statistical calculations.

- Class 3 Impacted (Unaffected) Areas: are all areas not classified as Class 1 or Class 2 Impacted. These areas are not expected to contain residual contamination above the applicable limits, based on knowledge of building history and previous survey information. However, insufficient documentation is present to exclude the area from survey requirements. The survey frequency will be a beta and/or alpha scan survey of

10% of the applicable surface areas, including fixed equipment and a minimum of one fixed survey measurement and one removable survey measurement per 50 square meters or 30 points, whichever is greater.

- Non-Impacted Areas: are all areas not classified as Class 1, Class 2 or Class 3 Impacted. These areas are areas where there is no reasonable potential for residual contamination, based on knowledge of building history and/or previous survey information. Sufficient information is present to be assured that no residual contamination is present above the applicable contamination limits.

In addition to fixed and removable surveys, surface media samples of painted surfaces to be released in an unrestricted manner, will be obtained at frequencies determined in accordance with MARSSIM calculations. The sampling methodology as well as the number of samples required for each survey and will be delineated in individual Radiological Survey Instructions.

To what radiological hazards could the worker be exposed?

High levels of plutonium, americium, and uranium exist in the gloveboxes, and ventilation systems. These nuclides present a significant internal radiological hazard if inhaled or ingested. From an external dose standpoint, the radiological hazard is minimal.

Step 5 - Develop a Decision Rule

What is the basis for the decision in Step 2?

The unrestricted release criteria outlined in Appendix A is the basis for deciding whether the structures and components of the 779 Cluster can be released in an unrestricted manner.

The survey frequency required to allow an unrestricted release is based on guidance from:

NUREG/CR-5849 - *Manual for Conducting Radiological Surveys in Support of License Termination.*

Draft MARSSIM - *Multi-Agency Radiation Survey and Site Investigation Manual.*

Are there any regulatory and statistical drivers for sampling frequency?

The survey frequency required to allow an unrestricted release is based on guidance from:

NUREG/CR-5849 - *Manual for Conducting Radiological Surveys in Support of License Termination.*

Draft MARSSIM - *Multi-Agency Radiation Survey and Site Investigation Manual.*

1-P73-HSP-18.10, *Radioactive Material Transfer and Unrestricted Release of Property and Waste.*

What are the required instrumentation sensitivities?

The instrumentation in Appendix B will be used to perform all radiological surveys. The Minimum Detectable Activities (MDA) of the instruments used to perform the surveys required in this CRSP will be a fraction of the unrestricted release criteria outlined in Appendix A. A goal will be to have the MDA of an instrument at or below 50% of the unrestricted release criteria. The MDAs listed are worse case based on the lowest acceptable efficiency and highest acceptable background. Additional survey equipment may be used as required by Radiological Engineering.

What action levels are applicable to the decision or parameter of interest?

The unrestricted release criteria is outlined in Appendix A.

Define the decisions using "if...then" statements.

If the structures and components of the 779 Cluster contain no radioactive material above the unrestricted release criteria, then those components may be released in an unrestricted manner.

If the structures and components of the 779 Cluster contain radioactive material above the unrestricted release criteria, then those components will be decontaminated or removed.

If decontaminated structures and components of 779 Cluster contain radioactive material above the unrestricted release criteria, then those components will not be released in an unrestricted manner.

If removed materials (structures and components) are radioactively contaminated, then those removed materials will not be released in an unrestricted manner.

Step 6 - Specify Limits on Decision Errors

What sample size is necessary for the analysis being completed?

The sample size is defined for different areas in the 779 Cluster as outlined below:

The survey units have been limited in size to ensure each area is assigned an adequate number of data points. The suggested maximum areas for survey units are;

- 100 m^2 for Class 1 Areas
- 1000 m^2 for Class 2 Areas
- No limit for Class 3 Areas

There will not be any survey units less than 10 m^2 in size in order to achieve an acceptable sample population.

The floors, walls, ceilings, roof and fixed equipment will be surveyed for fixed and removable, gross beta and/or alpha contamination as indicated in the example survey instructions provided in Appendix F.

What number of samples/measurements will provide the desired certainty?

Both MARSSIM and NUREG CR-5849 provide the desired certainty for final survey, and both references will be utilized as follows:

Classifications for survey requirements will be made as delineated in MARSSIM. The number of survey measurements for Class 1 and Class 3 areas will be performed in accordance with NUREG/CR-5849 which is typically more conservative than the MARSSIM statistical calculation methodology. Initial classifications for the 779 Cluster are Classes 1 and 3. If the Class 2 classification is used, the number of survey measurements will be calculated in accordance with MARSSIM.

Initial classifications of areas may be downgraded during characterization and in-process surveying based on sound engineering judgment by Radiological Engineering, if desired.

Class 1 Impacted Areas Survey and Sampling Requirements

- A 100% beta and/or alpha scan will be performed on accessible surfaces.
- One fixed beta and/or alpha total surface activity measurement for each one square meter.
- One beta and/or alpha removable activity measurement for each one square meter.

Class 2 Impacted Areas Survey and Sampling Requirements

- A 50% beta and/or alpha scan based on total survey surface area will be performed on selected biased locations.
- One fixed beta and/or alpha total surface activity measurement based on MARSSIM statistical calculations.
- One beta and/or alpha removable activity measurement based on MARSSIM statistical calculations.

Class 3 Impacted Areas Survey and Sampling Requirements

- A 10% beta and/or alpha scan based on total survey surface area will be performed on selected biased locations.
- One fixed beta and/or alpha total surface activity measurements for each fifty square meters or thirty measurements whichever is greater.
- One beta and/or alpha removable activity measurement for each fifty square meters or thirty measurements whichever is greater.

Non-Impacted Areas Survey and Sampling Requirements

No surveys are required.

What is the expected range of the parameter of interest?

All parameter values are expected to be less than the unrestricted release criteria outlined in Appendix A.

Define both types of decision errors, (false negative and false positive)?

False negative (Type 1) errors would occur when a detectors response is below the unrestricted release criteria when, in fact, radioactive material is present above the unrestricted release criteria.

False positive (Type 2) errors would occur when a detectors response is above the unrestricted release criteria when, in fact, radioactive material is not present above the unrestricted release criteria.

What are the potential consequences of an incorrect decision?

For false negative errors, area/material would be released in an unrestricted manner when it should not be released in an unrestricted manner.

For false positive errors, area/material would not be released in an unrestricted manner when it should be released in an unrestricted manner.

What are the limits on decision errors?

The instrumentation in Appendix B will be used to perform all radiological surveys. The Minimum Detectable Activities (MDA) of the instruments used to perform the surveys required in this CRSP will be a fraction of the unrestricted release criteria outlined in Appendix A. A goal will be to have the MDA of an instrument at or below 50% of the unrestricted release criteria. The MDAs listed are worse case based on he lowest acceptable efficiency and highest acceptable background. Additional survey equipment may be used as required by Radiological Engineering. The use of these instruments with their associated MDAs below the unrestricted release criteria can assure that false negative and false positive errors are minimized.

Step 7 - Optimize the Decision for Obtaining Data

What method will be used to obtain the desired information?

The survey methods to be utilized are in conformance with the following RFETS procedures:

4-K62-ROI-03.01	*Performance of Surface Contamination Surveys*
4-S23-ROI-03.02	*Radiological Requirements for Unrestricted Release*
4-Q97-REP-1003	*Radiological Evaluation for Unrestricted Release of Property/Waste*
1-P73-HSP-18.10	*Radioactive Material Transfer and Unrestricted Release of Property and Waste*
DOE Order 5400.5	*Radiation Protection of the Public and the Environment*
NRC Reg. Guide 1.86	*Termination of Operating Licenses for Nuclear Reactors*

What level of worker protection is required to perform survey and other work in the facility, structure or environs?

Standard industrial safety practices are utilized. Worker personnel protection clothing is identified in the Activity Hazard Analysis and RWP, if required. Safety glasses, safety shoes, and leather gloves are required by the task AHA. When final surveys are scheduled to be performed, it is not suspected that removable radioactive contamination will be present on the surfaces being surveyed. Therefore, no radiological protection is required.

How will the survey design be optimized?

Measurement locations will be clearly identified to provide a method of referencing survey results to survey measurement locations. Gridding will be used for the floors and walls for areas with Class 1 or Class 2 final classifications. Grids may be marked by paint, a chalk line, or labels at grid locations. In areas where gridding is not practical or cost-effective, measurement locations will be marked with labels or similar method or delineated on a map as directed by Radiological Engineering.

Have data quantity and quality assurance requirements for sampling been reviewed and incorporated into the survey process?

Quality assurance is addressed in Section 11.0 of this CRSP. The survey reports are prepared and reviewed in accordance with RFETS procedures.

6.0 RADIOLOGICAL RELEASE CRITERIA

The surface contamination criteria presented on Appendix A, *Summary of Contamination Values for Unrestricted Release*, will be used as the release criteria for final survey. The survey methods and release criteria of Appendix A are in conformance with the following RFETS procedures and regulatory documents:

4-K62-ROI-03.01	*Performance of Surface Contamination Surveys*
4-S23-ROI-03.02	*Radiological Requirements for Unrestricted Release*
4-Q97-REP-1003	*Radiological Evaluation for Unrestricted Release of Property/Waste*
I-P73-HSP-18.10	*Radioactive Material Transfer and Unrestricted Release of Property and Waste*
DOE Order 5400.5	*Radiation Protection of the Public and the Environment*
NRC Reg. Guide 1.86	*Termination of Operating Licenses for Nuclear Reactors*

7.0 CLASSIFICATION OF AREAS BY CONTAMINATION POTENTIAL

All areas of the building cluster do not have the same potential for residual contamination and, therefore, do not require the same level of survey coverage to achieve an appropriate level of confidence that building surfaces satisfy established release criteria. This plan is designed such that areas with higher potential for contamination receive a higher degree of survey effort. This will ensure that the closeout radiological survey process is both effective and efficient. Refer to the Table D-1, *Building/Room Radiological Survey Classifications* in Appendix D, for each classification.

The following classifications and survey frequencies are based on the guidance from the following draft documents:

NUREG/CR-5849 - *Manual for Conducting Radiological Surveys in Support of License Termination*

MARSSIM - *Multi-Agency Radiation Survey and Site Investigation Manual*

- Class 1 Impacted (Affected) Areas: are areas that have potential contamination (based on building operating history) or known contamination (based on past or preliminary characterization survey data). This would normally include areas where radioactive materials were used and stored and where records indicate spills or other unusual occurrences could have resulted in the spread of contamination. The survey frequency will be a scan survey for beta and/or alpha of 100% of each one square meter of accessible surface area, including fixed equipment, and a minimum of one fixed survey measurement and one removable survey measurement per square meter.

- Class 2 Impacted Areas: are areas that have or had a potential for radioactive contamination or known contamination, but are not expected to exceed the applicable contamination limits. The survey frequency will be a scan survey for beta and/or alpha of 10 to 100% of the accessible surface areas, including fixed equipment, as specified in the survey instructions in Appendix E. In addition, a minimum of one fixed survey measurement, and one removable survey measurement at intervals as determined utilizing MARSSIM statistical calculations will be obtained.

- Class 3 Impacted (Unaffected) Areas: are all areas not classified as Class 1 or Class 2 Impacted or Non-Impacted. These areas are not expected to contain residual contamination above the applicable limits, based on knowledge of building history and previous survey information. However, insufficient documentation is present to exclude the area from survey requirements. The survey frequency will be a scan survey for beta and/or alpha of 10% of the accessible surface areas, including fixed equipment, and a minimum of one fixed survey measurement and one removable survey measurement per 50 square meters or 30 points, whichever is greater.

- Non-Impacted Areas: are all areas not classified as Class 1, Class 2 or Class 3 Impacted. These areas are areas where there is no reasonable potential for residual contamination, based on knowledge of building history and/or previous survey information. Sufficient information is present to be assured that no residual contamination is present above the applicable contamination limits.

8.0 RADIOLOGICAL SURVEY, SAMPLING METHODS AND FREQUENCY

The sampling frequency specified for the following classifications is based on the more conservative criteria delineated in Draft NUREG/CR-5849, *Manual for Conducting Radiological Surveys in Support of License Termination.* The accessible areas of floors, interior walls, ceiling, exterior walls, roof and fixed equipment will be surveyed for total, and removable alpha contamination. Because the 779 facility was an R&D facility, the potential exists for the presence of non-alpha emitting radionuclides particularly liquid sources. Therefore, for areas designated Class 1 or Class 2, the floors, walls and fixed equipment up to two meters, where the potential for spills of liquid sources is most probable, will be analyzed for total and removable beta contamination as well as alpha contamination as indicated in the survey instructions provided in Appendix E, and in accordance with the following:

8.1 SURVEY AREAS CLASSIFIED AS CLASS 1

8.1.1 Floors and Walls and Fixed Equipment up to two meters

A minimum of one fixed point and one removable alpha/beta measurement will be obtained for each square meter of surface area. In addition, a 100% alpha/beta scan will be performed on all applicable surface areas.

8.1.2 Walls and Fixed Equipment above two meters and Ceiling

A minimum of one fixed point and one removable alpha measurement will be obtained for each square meter of surface area. In addition, a 100% alpha scan will be performed on all accessible surfaces based on total survey unit surface area.

8.2 SURVEY AREAS CLASSIFIED AS CLASS 3

8.2.1 Floors, Walls, Ceilings, Roofs and Fixed Equipment

One fixed point and one removable alpha measurement will be obtained for each 50 m^2 of survey area or 30 measurements whichever is greater. In addition, a 10% alpha scan will be performed on all accessible surface based on total survey unit surface area at selected biased locations.

8.3 SOLID MEDIA SAMPLING

In addition to fixed and removable surveys, solid media samples of painted surfaces to be released in an unrestricted manner will be obtained at frequencies determined in accordance with MARSSIM calculations. The sampling methodology as well as the number of samples required for each survey area will be delineated in individual radiological survey instructions.

9.0 GRIDDING METHODOLOGY

Measurement locations will be clearly identified to provide a method of referencing survey results to survey measurement locations. Gridding will be used for the floors and walls for areas with Class 1 or Class 2 final classifications. Grids may be marked by paint, a chalk line, or labels at grid locations. In areas where gridding is not practical or cost-effective, measurement locations will be marked with labels or similar method or delineated on a map as directed by Radiological Engineering.

A typical reference coordinate system for the purpose of gridding is delineated in Appendix C. This coordinate system will be used to ensure each survey measurement location for a given survey area is unique. Survey maps with a similar type of gridding system will be provided prior to the performance of the final survey for each Class 1 or Class 2 area.

Class 3 areas will not typically be gridded, however maps will be provided to record the required survey locations. In addition, the survey location will typically be marked by marker or survey sticker on the surveyed surface.

10.0 RESPONSIBILITIES

10.1 779 CLOSURE PROJECT MANAGER (SSOC)

The Project Manager is responsible for reviewing and approving the 779 Cluster Decommissioning Project Closeout Radiological Survey Plan and Report.

10.2 779 CLOSURE INTEGRATION MANAGER (RMRS)

The Integration Manager is responsible for reviewing and approving the 779 Cluster Decommissioning Project Closeout Radiological Survey Plan and Report.

10.3 779 CLOSURE RADIOLOGICAL SAFETY AUTHORITY (SSOC)

The Radiological Safety Authority is responsible for:

- Providing overall Radiological Engineering guidance for the development of the 779 Cluster Decommissioning Project Closeout Radiological Survey Plan, including the evaluation and classification of the areas for survey.
- Reviewing and approving the 779 Cluster Decommissioning Project Closeout Radiological Survey Plan and Report.

10.4 779 CLOSURE FINAL SURVEY RADIOLOGICAL ENGINEER (RMRS)

The Final Survey Radiological Engineer is responsible for:

- Defining the content and ensure preparation of the 779 Cluster Decommissioning Project Closeout Radiological Survey Plan and Report.
- Evaluating the project structures and appropriately classify the areas for survey.
- Developing overall technical aspects, planning, and scheduling for implementation of the Closeout Radiological Survey Plan.
- Developing radiological survey instructions for individual survey areas.
- Resolving issues regarding survey layout and gridding requirements.
- Reviewing surveys and sample analysis results for completeness, accuracy, and legibility.

10.5 779 CLOSURE RADIOLOGICAL ENGINEER(S) (SSOC)

The Radiological Engineer(s) responsibilities include:

- Reviewing and approving the 779 Cluster Decommissioning Project Closeout Radiological Survey Plan and Report.
- Ensuring that the Closeout Radiological Survey developed is consistent with RFETS requirements.
- Reviewing survey data for completeness, accuracy, legibility. Ensuring discrepancies in survey data are identified and corrected.
- Assisting with the preparation of the Closeout Radiological Survey Report.
- Property Release Evaluation (PRE) form preparation.

10.6 779 CLOSURE RCT TECHNICAL SUPERVISORS

The RCT Technical Supervisors are responsible for:

- Reviewing and approving the 779 Cluster Decommissioning Project Closeout Radiological Survey Plan and Report
- Reviewing survey data for completeness, accuracy, legibility. Ensuring discrepancies in survey data are identified and corrected.
- Day-to-day supervision of the RCTs.

10.7 RADIOLOGICAL CONTROL TECHNICIANS

The Radiological Control Technicians are responsible for:

- Performing surveys in accordance with this plan, approved RFETS procedures, and direction provided by Radiological Engineering.
- Providing complete, accurate, and legible documentation for all surveys performed.

- Providing complete, accurate, and legible documentation for all surveys performed.

11.0 QUALITY ASSURANCE/QUALITY CONTROL

11.1 SURVEY DOCUMENTATION

Records of the survey will be maintained in a survey package. The survey package will be the primary method of controlling and tracking closeout radiological survey results. The records compiled in a survey package will include (if applicable):

- Completed Contamination Survey Results (Fixed and Removable)
- Completed PREs
- Survey Area Diagrams/Maps
- Printout Of Smear Survey Analysis
- Laboratory Analysis Results
- Data Analysis Summary
- Completed Chain Of Custody Forms

11.2 CHAIN OF CUSTODY (COC)

Samples will be managed to ensure that there is an accurate record of sample collection, transport, analysis, and disposal. This will insure that samples are neither lost nor tampered with and that the sample analyzed is traceable to a specific location in the field. COC documentation shall be completed for all samples submitted for laboratory analysis. The COC form will be included as part of the closeout radiological survey documentation.

11.3 ANALYTICAL LABORATORY QUALITY ASSURANCE/QUALITY CONTROL

All samples collected for special analysis will be analyzed by RFETS laboratories or an approved contracted laboratory. The analysis will be performed by trained individuals using appropriate equipment and procedures. The laboratory will have analytical capabilities for the radionuclides of interest (Plutonium, Americium, Uranium) and an established QA/QC program which assures the validity of the analytical results. The laboratory analytical methods will be capable of measuring levels below the established release criteria. All results will state the detection limit for the analysis.

12.0 DATA INTERPRETATION

12.1 REPORTING UNITS

All measurements will be reported in units appropriate for comparison with Appendix A surface contamination limits. Total and removable surface activity measurements will be reported in units of dpm per 100 cm^2.

Measurements of removable surface activity will be converted from gross count rate to units of net dpm per 100 cm^2 by subtracting the background count rate of the smear counting detector and correcting the net count rate for detector efficiency. Measurements of total surface activity will be converted from observed gross counts per minute to net dpm per 100 cm^2 by subtracting the background count rate and correcting the net count rate for detector efficiency and detector surface area.

Individual measurement results will be compared against the average and the maximum release criteria in Appendix A. Measurement results less than the average guideline value will be deemed acceptable. Measurement results greater than the maximum guideline value will indicate a need for remediation. Measurement results greater than the average guideline value but less than the maximum release criteria will require investigation to determine if the average of five measurements within a given one m^2 exceeds the average release criteria. Investigations will be performed as directed by Radiological Engineering and will demonstrate compliance with release criteria when averaged over a maximum of one m^2.

Scan surveys will be performed for the percentage required in the Radiological Instructions. However, only results that exceed RFETS limits will be recorded. The percentage scanned for each survey area will be annotated on the applicable survey map(s).

12.2 NINETY-FIVE PERCENT CONFIDENCE LEVEL

Once the individual measurements have demonstrated compliance with the release criteria, the confidence interval will be calculated using normal statistics (one-tailed test) at the 95% confidence level on the data from each survey area.

13.0 REPORTING SURVEY FINDINGS

A Closeout Radiological Survey Plan Report will be prepared at the conclusion of the project. The report will be prepared by the Final Survey Radiological Engineer and the cognizant SSOC Radiological Engineer. A summary of the following measurement results and overall conclusions showing that the building surfaces meet the release criteria will be provided.

- Removable Surface Beta-Gamma Activity
- Removable Surface Alpha Activity
- Total Surface Beta-Gamma Activity
- Total Surface Alpha Activity
- QA Sample Results
- Core Samples (If obtained)

In addition, the upper confidence limit (UCL) about the mean (95% confidence level) will be reported for comparison to the release criteria.

14.0 REFERENCES

NUREG/CR-5849 - *Manual For Conducting Radiological Surveys In Support Of License Termination* (Draft).

MARSSIM - *Multi-Agency Radiation Survey And Site Investigation Manual* (Draft).

DOE Order 5400.5 - *Radiation Protection of the Public and the Environment.*

NRC Reg. Guide 1.86 - *Termination of Operating Licenses for Nuclear Reactors.*

4-K62-ROI-03.01, *Performance Of Surface Contamination Surveys.*

4-S23-ROI-03.02, *Radiological Requirements For Unrestricted Release.*

4-Q97-REP-1003, *Radiological Evaluation For Unrestricted Release Of Property/Waste.*

I-P73-HSP-18.10, *Radioactive Material Transfer And Unrestricted Release Of Property And Waste.*

Reconnaissance Level Characterization Report For The Building 779 Closure Project, November 1997.

Decommissioning Program Plan, November 1997.

DOE, 1996, *Final Rocky Flats Cleanup Agreement*, Rocky Flats Environmental Technology Site, Golden, CO.

Appendix A

Summary Of Contamination Values

For Unrestricted Release

Appendix A

Summary Of Contamination Values

For Unrestricted Release

Summary Of Contamination Summary Of Contamination Values For Unrestricted Release

RADIONUCLIDE (1)	**Average Total (Fixed + Removable) Contamination dpm/100 cm^2** (2), (3), (4)	**Maximum Total (Fixed + Removable) dpm/100 cm^2** (2),(4), (5)	**Removable dpm/100 cm^2** (2), (4), (6)
Transuranics, Ra-226, Ra-228, Th-228, Pa-231 , Ac-227, I-125, I-129	100	300	20
Th-Natural, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-131, I-133	1,000	3,000	200
U-Natural, U-235, U-238, and associated decay products, alpha emitters	5,000	15,000	1,000
Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above (7)	5,000	15,000	1,000

NOTES:

1. Where surface contamination by both alpha and beta-gamma emitting radionuclides exists, the limits established for alpha and beta-gamma emitting radionuclides should apply independently.

2. As used in this table, disintegrations per minute (dpm) is defined as the rate of emission by radioactive material as determined by correcting the counts per minute measured by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

   Measurements of average contamination should not be averaged over an area of more than 1 meter^2. For objects with a total surface area of less than 1 meter^2, the average should be derived for each object.

   The average and maximum dose rates associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 m Rad/hour and 1.0 m Rad/hour, respectively at 1 cm.

3. The maximum contamination level applies to an area of not more than 100 cm^2.

4. The amount of removable material per 100 cm^2 of surface area should be determined by wiping an area of that size with a dry filter of soft absorbent paper, applying moderate pressure, and measuring the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of surface area less than 100 cm^2 is determined, the activity per unit area should be based on the actual area and the entire surface should be wiped. Except for transuranics and Ra-228, Ac-227, Th-228, Th-230, Pa-231, and alpha emitters, it is not necessary to use swiping techniques to measure removable contamination levels if direct scan surveys indicate the total residual surface contamination levels are within the limits for removable contamination.

5. This category of radionuclides includes mixed fission products, including the Sr-90 which is present in them. It does not apply to Sr-90 which has been separated from the other fission products or mixtures where the Sr-90 has been enriched.

Appendix B

Instrumentation

Instrumentation

Instrument	Count Type	Allowable Background Counts	Acceptable Application	MDA (dm/100 cm^2)
Bicron w/ A100 Probe	60 sec. (alpha)	2	Direct Alpha Surveys (Total Alpha Activity	55
Bicron w/ B50 Probe	60 sec (beta)	250	Direct Beta Surveys (Total Beta Activity)	610
NE Electra w/ DP6 Probe	60 sec. (alpha) 60 sec. (beta)	2 700	Direct Alpha Surveys (Total Activity) Direct Beta Surveys (Total Activity)	60 455
SAC-4	60 sec. (alpha)	1	Removable Alpha Swipes	18
LB-5100W	60 sec.* (alpha) 60 sec. (beta)	0.5 4	Simultaneous Removable Alpha and Beta Swipes	20* (alpha) 35 (beta)
BC-4	60 sec. (beta)	200	Removable Beta Swipes	205

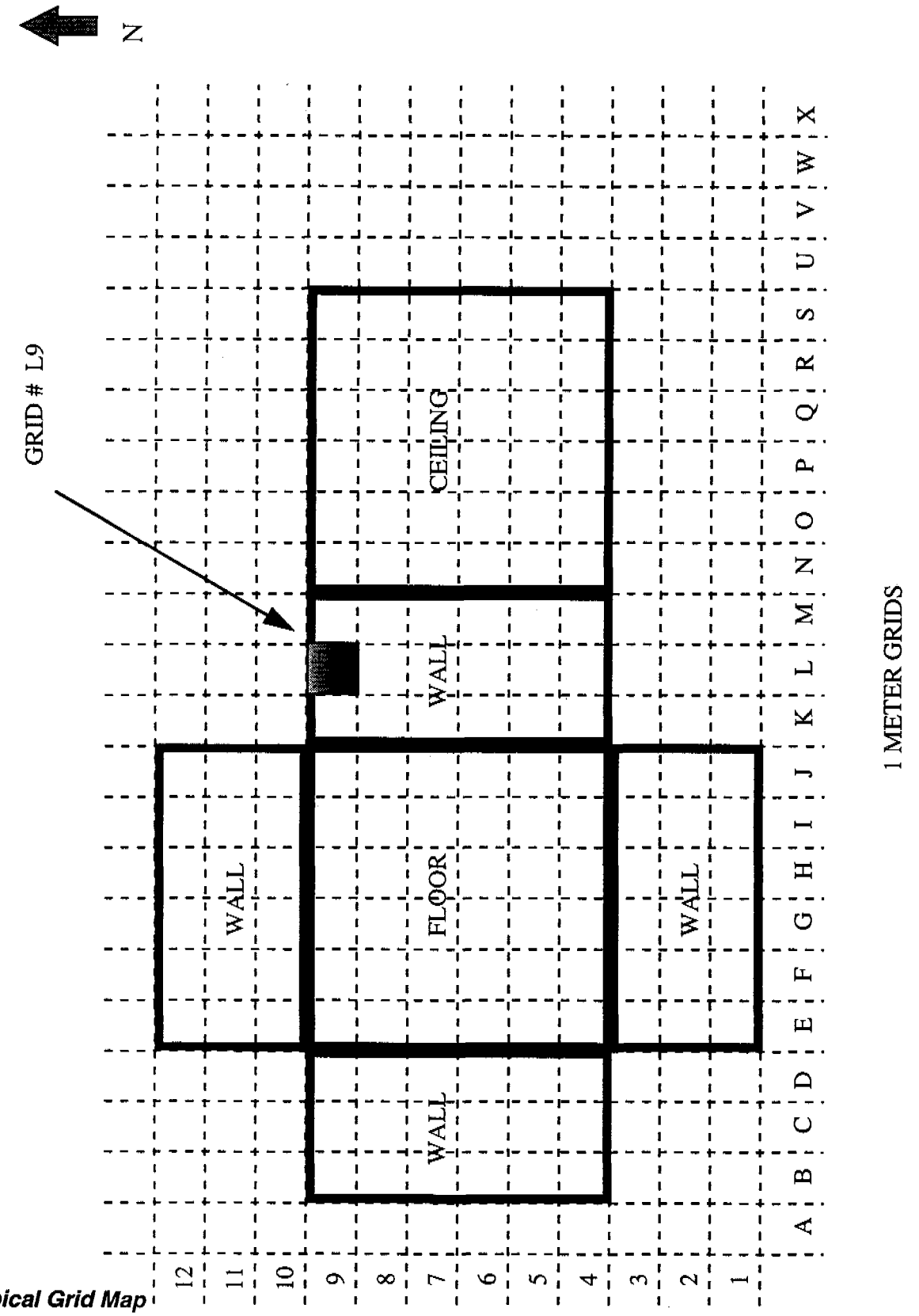
* This 60 second count time can be increased to assure that the MDA is a fraction of the unrestricted release.

Laboratory Instrumentation

Typical laboratory instrument is used for on-site analysis includes but is not limited to alpha spectroscopy systems, gamma spectroscopy systems, low background alpha/beta gas flow proportioned systems and liquid scintillation counting systems. MDAs are determined on an individual basis for each sample to be analyzed. Adequate sample volume will be obtained to ensure reasonable MDAs are obtained.

Appendix C

Typical Grid Map



Typical Grid Map

Appendix D

Building/Room Radiological Survey Classifications

Room No.	Process Information	Classification
001	This sub-basement contained the process piping for the T-5 tank which was the holding tank for all B779 process drains. This tank was flushed and triple rinsed.	Class 1
100	Entrance	Class 3
101A	Foyer	Class 3
102		Class 3
103	Men's Locker room	Class 1
103A	Men's Restore	Class 1
103B		Class 1
104	Elevator	Class 3
105	Hallway	Class 3
106	Office	Class 3
107	Office	Class 3
108	Office	Class 3
109	Office	Class 3
110	Office	Class 3
110A	Office	Class 3
111	Office	Class 3
113	Assembly Technology Machine Shop	Class 1
114		Class 1
115		Class 1
115A		Class 1
116		Class 1
116A		Class 1
117		Class 3
118	Airlock	Class 1
119	Hallway	Class 1
120	Old Change Room	Class 1
121	Maintenance Shop	Class 3
122	Control Room	Class 3
123	This was the decontamination room and likely has contamination in the process drains leading from it.	Class 1
124	This was an Radiation Control Technician (RCA) office.	Class 1
125	This room was an RCA office. Radiation sources were stored in the northeast corner of the room.	Class 1
126	This was a utility area and should not contain appreciable amounts of Pu other than what might be in process piping. There were gloveboxes for house vacuum and batteries for uninterrupted emergency power supply. In Room 126, there was a helium tank system and scrubber on the west wall for a helium inert glovebox in Room 133. It was abandoned in the late 1970s or early 1980s. The system never went hot.	Class 1

Room No.	Process Information	Classification
126 cont'd	The room above the T-5 tank housed pumps and two cooling water system tanks. There were two other pits in addition to the one containing the T-5 tank that were accessed from the pump room. These pits are contaminated.	
127	This was a utility room containing chillers and part of the building's original ventilation system. The filter plenum was contaminated.	Class 1
128	This room was used for repair of radiation instruments. Radiation sources were stored in this room.	Class 1
129	Stairwell	Class 1
130	Janitor Closet	Class 1
131	This was an aqueous laboratory supporting pyrochemical technology.	Class 1
132	Source Check Lab	Class 1
133	Residue Storage	Class 1
134	Flammable Storage	Class 1
135	Supply Storage	Class 1
136	Chemical Technician Office	Class 1
137	Residue Recovery Extraction	Class 1
138	Storage	Class 1
139	Ferrite Actinide Removal	Class 1
140	Metal Preparation Laboratory	Class 1
140A	Scanning Electron Support Room	Class 1
140B	Scanning Electron Microscope (SEM)	Class 1
141	ESCA for non-radioactive analysis	Class 1
141A	Metallurgy Laboratory, Salt Crete Analysis	Class 1
141B	This room had a scanning electron microscope.	Class 1
141C	This room contained an metallograph and optical reduction equipment. This equipment was used to photograph samples.	Class 1
142	This was a utility room which contained part of the building's original ventilation system. This room was used as a RCRA storage unit for waste oil.	Class 1
143	Airlock to Annex	Class 1
144		Class 1
145		Class 1
146	Office Area	Class 1
147	This room was used for drum storage for radiological waste. It also supported Room 150 with nuclear joining.	Class 1
148	Airlock	Class 1
149	Hallway	Class 1
149	Hallway	Class 1

Room No.	Process Information	Classification
150	Room 150 was used for nuclear joining of metal weapon components and for super critical CO^2 cleaning. Cleaning and rinsing of the components was performed prior to the welding operation. The process involved torch brazing.	Class 1
151	Office	Class 1
152	Room 152 was used as an experimental casting lab to test metal compatibility with graphite mold substrates. Pu and non-nuclear metals were heated until molten and poured into graphite molds. The molds were then examined and analyzed.	Class 1
153	This room was used for radiological waste drum storage and contained a trash compactor.	Class 1
153A	This room had a compactor for hot waste, a lead drum shield, two bottles, and three abandoned pumps. This room appears to have been used for drum storage at one time.	Class 1
153B	This room had a downdraft table used to repackage waste. The room is posted as respiratory protection required.	Class 1
154	This room was used for hydrating and dehydrating Pu from substrates. Hydride could still be present. Gloveboxes 1363 and 1364 is where hydrating/dehydrating was accomplished.	Class 1
155	This room was Pu sample-mounting laboratory support auger spectroscopy. It had etching, polishing, a furnace, and B-boxes to pull samples out of line.	Class 1
156	This room was the calorimeter room.	Class 1
157		Class 1
158		Class 1
159	This was a permitted storage area for RCRA waste (Unit 779-90.42). There were several drums stored here containing mixed residues.	Class 1
160	This room was retrofitted in the early 1980s as a pyrochemical development facility. Operations that took place in this room included DOR, ER, MSE, Salt Scrub, and other high temperature studies with Pu and Am. In 1985 there was a major stationary furnace breach in Glovebox 865 which contaminated the entire room with Pu and Am. Smears taken immediately after room around the room measured infinity. It took an entire year to completely decontaminate the room. Walls, floors, ceiling, and pipes were painted after decontaminated to fix remaining contamination. There was reported contamination in the room's ventilation system. This contamination may have migrated to adjacent rooms.	Class 1
160A	Room 160A was a vault which contained Special Nuclear Material (NSNM). SNM was removed from this vault in 1996.	Class 1
161	Janitor Closet	Class 1
162	Machine Shop	Class 1
163	This room was used for empty drum storage.	Class 1
163A	Office	Class 1

Room No.	Process Information	Classification
164	Hallway (Airlock)	Class 1
165	Double Doors	Class 1
166	Airlock	Class 1
167	Women's Locker Room	Class 1
170	Closet	Class 1
171	This room contained SNM storage vaults and had Benelex-shielded cubicles.	Class 1
172	A chainveyor vault is located in Room 172.	Class 1
173	Utility Area, Mechanical Room	Class 3
201		Class 3
201A		Class 3
201B		Class 3
202	Office	Class 3
202A		Class 3
203	Office	Class 3
204	Office	Class 3
204A	Office	Class 3
205	Office	Class 3
206	Office	Class 3
207A	Office	Class 3
207B	Office	Class 3
207C	Office	Class 3
207D	Office	Class 3
208	Office	Class 3
209	Office	Class 3
210	Office	Class 3
211	Office	Class 3
212	Office	Class 3
212A	Office	Class 3
213	Office	Class 3
214	Office	Class 3
215	Hallway (Airlock)	Class 1
216	Hallway	Class 1
217	Room 217 was a part of Product Physical Chemistry which performed research and development studies for production support, product material surveillance, material research, and material compatibility studies.	Class 1
218	Room 218 was a part of Product Physical Chemistry which performed research and development studies for production support, product material surveillance, material research, and material compatibility studies.	Class 1
219	Restroom	Class 1
220	Metallurgy Laboratory Polymer Preparation Plutonium reaction studies.	Class 1
221		Class 1
221B	There was a drum liner stored here with fixed contamination. There was also laboratory jack which has fixed contamination. There was an uncontaminated vacuum system also present.	Class 1

Room No.	Process Information	Classification
222	Room 222 was a part of Product Physical Chemistry which performed research and development studies for production support, product material surveillance, material research, and material compatibility studies.	Class 1
222A	Storage Room	Class 1
223	Room 223 was a coatings laboratory which coated U, Be, stainless steel, and aluminum parts with a thin layer of metal. The basic process equipment consisted of a vacuum chamber, arc welder, vacuum pump, and associated water cooling equipment.	Class 1
224	Decontamination Room	Class 1
225	Room 225 was a coatings laboratory which coated U, Be, stainless steel, and aluminum parts with a thin layer of metal. The basic process equipment consisted of a vacuum chamber, arc welder, vacuum pump, and associated water cooling equipment.	Class 1
226	Stairway	Class 1
228	This room was used for sample preparation for X-ray analysis, Pu metallurgy, and tensile testing.	Class 1
229	Office	Class 1
230	Office	Class 1
231	Office	Class 1
232	Office	Class 1
233	Office	Class 1
234	Room 234 was a part of the Pu physical metallurgy research and development group which prepared, analyzed, and collected various metallurgical samples.	Class 1
234A	Fixed contamination under paint, also contained X-ray machine.	Class 1
234B	Previous darkroom	Class 1
235	This room had a contaminated transmission electron microscope.	Class 1
236	Airlock and Bridge to B777	Class 1
237	Hall to Annex	Class 1
270	Room 270 was a part of Product Physical Chemistry which performed research and development studies for production support, product material surveillance, material research, and material compatibility studies.	Class 1
271	Room 271 had low-level mixed waste storage cabinets for treatability studies where samples were being stored by the Polymer Development Team. These are also were used for storage of archived low-level mixed waste samples.	Class 1
272	This was a testing laboratory.	Class 1
273		Class 1
274	Equipment Storage	Class 1
275	Equipment Storage	Class 1
277	Equipment Storage	Class 1
B779 Exterior	Exterior walls and roof	Class 3
B727	Building 727 housed a 500 kilowatt generator which provided emergency power to Building 782. The building is approximately 380 sq. ft. and is constructed of concrete block and reinforced concrete.	Class 3

Room No.	Process Information	Classification
271	Room 271 had low-level mixed waste storage cabinets for treatability studies where samples were being stored by the Polymer Development Team. These are also were used for storage of archived low-level mixed waste samples.	Class 1
272	This was a testing laboratory.	Class 1
273		Class 1
274	Equipment Storage	Class 1
275	Equipment Storage	Class 1
277	Equipment Storage	Class 1
B779 Exterior	Exterior walls and roof	Class 3
B727	Building 727 housed a 500 kilowatt generator which provided emergency power to Building 782. The building is approximately 380 sq. ft. and is constructed of concrete block and reinforced concrete.	Class 3
B727	Exterior walls and roof	Class 3
B729	This plenum building is approximately 3,000 ft2 and is a one-story concrete block building with a small penthouse on the roof. This building is located south of Building 779 and provided Zone 1 and room air ventilation to the storage vaults and the rooms directly above the storage vaults on the south side of Building 779. Buildings 779 and 729 are connected by an overhead tunnel containing exhaust ductwork. Building 729 contained two filter banks, a four-stage and a two-stage glovebox and room air respectively. There was a control room and a 150 kilowatt emergency generator. There are two pits located in the building to collect fire sprinkler wastewater.	Class 1
B729 Exterior	Exterior walls and roof	Class 3
B780	Building 780 is a corrugated metal shed attached to the northeast corner of Building 779. It was used to store paint, solvents, miscellaneous equipment, and other material. Interior and exterior walls and roof.	Class 3
B780A/B	Building 780A is another storage facility located east of Building 779 which is constructed of corrugated steel. Interior and exterior walls and roof.	Class 3
B782	This plenum building is approximately 6,200 ft^2 and is a one-story precast, reinforced concrete building. It is located east of Building 779 and provided Zone 1 and room air ventilation to the rest of Building 779. Buildings 779 and 782 are connected by an underground tunnel containing exhaust ductwork. Building 782 contained three exhaust plenums for Buildings 779 and 782 and a supply air plenum for Building 782.	Class 1
B782 Exterior	Walls and roof	Class 3
B783 & Cooling Towers	Building 783 and auxiliary buildings provided cooling water to Building 779. It is constructed of aluminum, steel, and reinforced concrete.	Class 3

Appendix E

Surface Media Sampling

for

Transuranic Alpha Contamination

SURFACE MEDIA SAMPLING FOR TRANSURANIC ALPHA CONTAMINATION

- At the locations designated by Radiological Engineering, a 12" by 12" sample area is marked (or a suitable sized sample area as specified by radiological engineering).
- A fixed and removable survey for alpha is obtained.
- A plastic bag or equivalent is affixed beneath the sample location to collect the sample media.
- An appropriate tool is used to obtain a sample by removing the surface material to a depth of 1/16 to 1/8 of an inch over the entire sample surface area.
- The sample media is weighed, transferred to a labeled sample container and the required chain of custody documentation is completed.
- The sampling tool is wiped down to remove loose sample media and prevent possible sample cross-contamination.
- The above steps are repeated at each designated sample location.

SURFACE MEDIA SAMPLE RESULTS vs SURFACE RELEASE CRITERIA

pCi activity in a 12" x 12" surface media sample is converted to 100 dpm/100 cm^2 (which is the average transuranic alpha surface contamination limit from DOE order 5400.5) as follows:

Equivalent pCi transuranic alpha activity = (100 dpm/ 100 cm^2 X 928.8 cm^2) / (2.22 dpm/pCi * 100)

The total equivalent bulk transuranic alpha activity for a 12" by 12" sample is equal to 418.4 pCi

Where:

- 100 dpm/ 100 cm^2 is the average transuranic alpha surface contamination limit
- 928.8 cm^2 is the 12" X 12" surface area of the sample
- 2.22 is the activity conversion from dpm to pCi
- 100 converts from 100 cm^2 to cm^2

Since typically laboratory results are reported in pCi/gm, and this is the total activity of the sample, the mass of the sample must be known and the pCi/gm value multiplied by the total sample mass.

For example:

If the laboratory result is 5 pCi/gm transuranic alpha, and the total samples mass was 100 gms, the total activity is 500 pCi/gm and the result exceeds the total equivalent bulk activity limit of 418.4 pCi (transuranic surface contamination limit of 100 dpm/100 cm^2) and additional sampling would be required.

The actual average total surface activity is calculated as follows:

Total Surface Activity (TSA) (in dpm/ 100 cm^2) = [Sample weight (grams) X Sample Results (pCi/gm) X 2.22 dpm/pCi X 100] / [Sample Area (cm^2)]

TSA = (100 gms X 5.0 pCi/gm X 2.22 dpm/100 cm^2 X 100) / (928.8 cm^2)

= 119.5 dpm/100 cm^2

NOTE: The above methodology may be applied to other nuclides by applying the appropriate surface contamination limit (e.g., 5000 dpm/100 cm^2 for beta activity.)

Appendix F

Radiological Survey Instructions

SURVEY INSTRUCTIONS PREPARED BY				SURVEY INSTRUCTIONS REVIEWED BY			
Prepared By	Printed Name	Emp. No	Date	Reviewed By	Printed Name	Emp. No.	Date

SPECIAL INSTRUCTIONS

1. Number floor, wall, and overhead equipment sample locations on applicable survey map(s).
2. Obtain fixed and removable alpha measurements and record actual numeric results above and below MDA for the specified survey
3. Perform an alpha scan survey on 10% of the total interior and exterior surface areas, at locations with the highest potential for con
4. Record scan locations as "clouds" on the survey map(s) provided.
5. Obtain additional fixed & removable alpha measurements at all areas where alpha scan survey readings exceed 100 dpm/100 cm
6. Record additional measurements obtained and the measurement locations on the additional data sheet provided. Copy data shee
7. If unable to obtain measurements as required, mark "N/A" in the appropriate blocks, and state the reason in the commen
8. If smears are counted on the Tennelec, mark "See Attached" in the appropriate blocks and attach the computer printout(s)
9. Surveys to be performed in accordance with the following:
   4-K62-ROI-03.0 Performance of Surface Contamination Surveys
   4-S23-ROI-03.0 Radiological Requirements for Unrestricted Release
10. Material and equipment to be released in accordance with:
    1-P73-HSP-18.1 Radioactive Material Transfer and Unrestricted Release of Property and Waste
11. If this is a final survey, isolation controls of the surveyed area should be established as directed by Radiological Engineering.

EXAMPLE

REMOVABLE CONTAMINATION SURVEY INSTRUMENT DATA				
Mfr.	Tennelec	Eberline	Eberline	Eberline
Model				
Serial #				
Cal. Due Date				
Alpha Bkg (max =				
Alpha Eff.				
Calculated MDA				

MDA = CF x [2.71+ {3.29 x SQRT(bkg x ct (1 + ts/ tb))}]

TOTAL CONTAMINATION SURVEY INSTRUMENT DATA		
Mfr.	N.E. Tech	N.E. Tech
Model	Electra	Electra
Serial #		
Cal. Due Date		
Alpha Bkg (max =		
Alpha Eff.		
Calculated MDA		

MDA = CF x [2.71+ {4.65 x SQRT(bkg)}]

SURVEY PERFORMED BY			
RCT Signature	Printed Name	Emp. No	Date
RCT Signature	Printed Name	Emp. No	Date

SURVEY REVIEWED BY			
R.O. Supervision	Printed Name	Emp. No.	Date

COMMENTS

Sample Number	Grid Location or Description	Alpha Smear Results (dpm/100 cm ^{2})	Total Alpha Results (dpm/100 cm ^{2})	Beta Smear Results (dpm/100 cm ^{2})	Total Beta Results (dpm/100 cm ^{2})	% Surface Scan	Special Survey Instructions
1	E4					100	Obtain measurements on accessible floor surfaces
2	E5					100	Obtain measurements on accessible floor surfaces
3	E6					100	Obtain measurements on accessible floor surfaces
4	E7					100	Obtain measurements on accessible floor surfaces
5	E8					100	Obtain measurements on accessible floor surfaces
6	E9					100	Obtain measurements on accessible floor surfaces
7	F9					100	Obtain measurements on accessible floor surfaces
8	F8					100	Obtain measurements on accessible floor surfaces
9	F7					100	Obtain measurements on accessible floor surfaces
10	F6					100	Obtain measurements on accessible floor surfaces
11	F5					100	Obtain measurements on accessible floor surfaces
12	F4					100	Obtain measurements on accessible floor surfaces
13	G4					100	Obtain measurements on accessible floor surfaces
14	G5					100	Obtain measurements on accessible floor surfaces
15	G6					100	Obtain measurements on accessible floor surfaces
16	G7					100	Obtain measurements on accessible floor surfaces
17	G8					100	Obtain measurements on accessible floor surfaces
18	G9					100	Obtain measurements on accessible floor surfaces
19	H9					100	Obtain measurements on accessible floor surfaces
20	H8					100	Obtain measurements on accessible floor surfaces
21	H7					100	Obtain measurements on accessible floor surfaces
22	H6					100	Obtain measurements on accessible floor surfaces
23	H5					100	Obtain measurements on accessible floor surfaces
24	H4					100	Obtain measurements on accessible floor surfaces
25	I4					100	Obtain measurements on accessible floor surfaces
Comments:							

EXAMPLE